Surface Characterization of UV-treated Poly-(butylene-terephtalate)

H. Schieferdecker[1], M. Haider[2](✉), A.Kuhn[2], A-L. Gauthier[2] , S.Hild[1] and O.Marti[1]

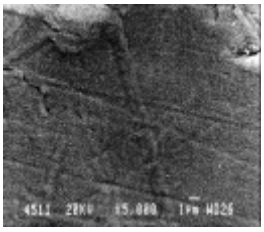
[1]*Institute of Experimental Physics, University of Ulm, Germany*
[2]*Central Department of Analytical Chemistry, Wacker Chemie GmbH, Germany, markus.haider@wacker.com*

Introduction

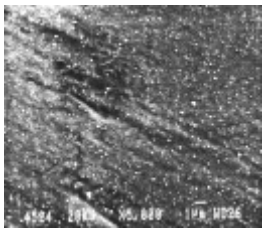
PBT was exposed to UV-radiation on a time scale of a few seconds to minutes using a medium pressure mercury arc lamp (254 nm, ≤ 200 mW/cm^2). Chemical changes of the surface were studied by FT-IR in conjunction with microtoming. Surface topography was determined by SEM and pulsed force mode scanning force microscopy (PFM-SFM). Besides, the change of the static contact angle over time was recorded and was correlated to the change of surface adhesion investigated with PFM-SFM.

Topographical Images (SEM, PFM-SFM)

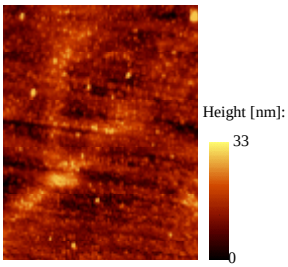
Top views of PBT (SEM images)



Non-illuminated.

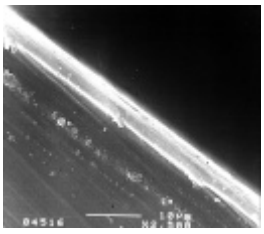


1 min illuminated; particle diameter: 100 - 400 nm.



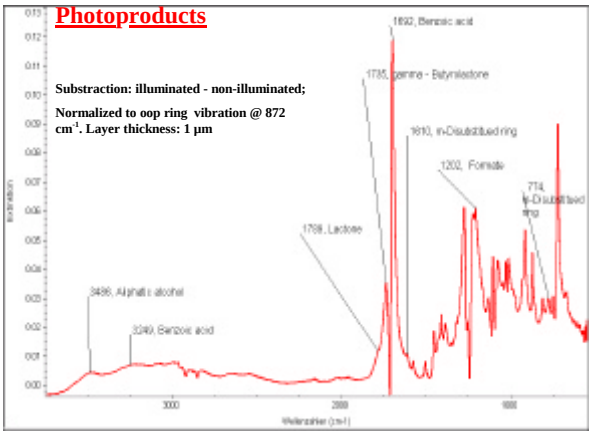
SFM-image (5 µm x 5 µm);, 1 min. illuminated.

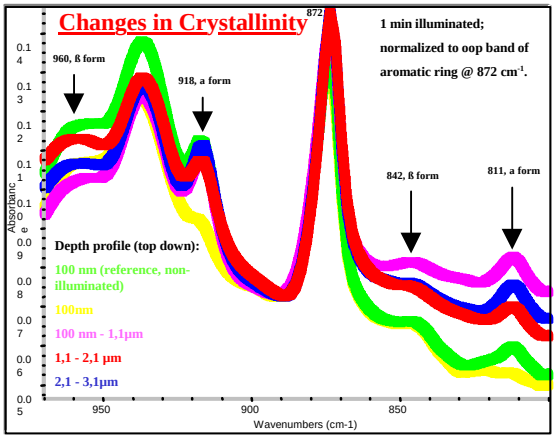
Cross-sectional SEM image



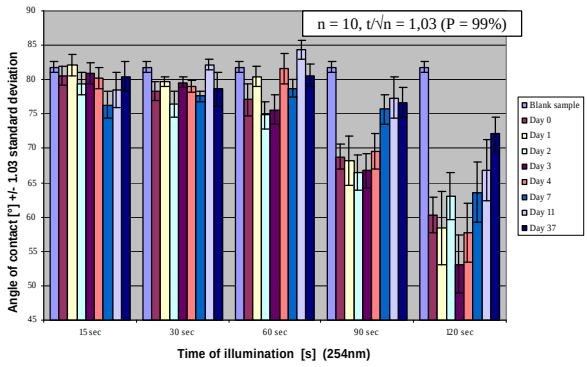
1 min illuminated; layer thickness: 4 - 6 µm

FT - IR (upon microtoming)

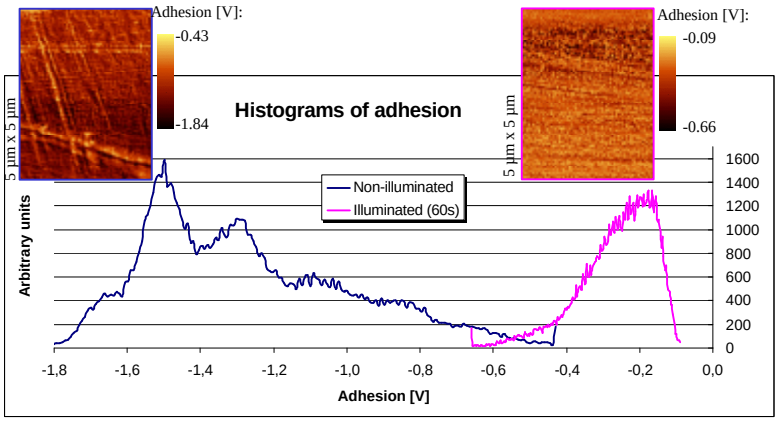




Contact angle measurements (distilled water on PBT)



Adhesion measured by PFM-SFM



Conclusion

Even short-time exposure to UV-irradiation shows significant effects:

- Pimple-like structures (LMWOM) and photoproducts (see SEM, SFM, IR);
- Loss of crystallinity, particularly in the topmost layer (see IR);
- Enhancement of surface wettability (macroscopic: see contact angle);
- Significant change of adhesion (microscopic: see PFM-SFM).

Bibliography

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